

CLAIMS

What is claimed is:

1. A fuel cell (12) for generating electrical current from first and second reactant streams, comprising:
 - a. a membrane electrode assembly (46);
 - b. a first reactant flow field (80) secured adjacent a surface selected from the group consisting of a first surface (48) and a second surface (50) of the membrane electrode assembly (46) for directing flow of a first reactant adjacent the selected surface (48, 50) of the assembly (46); and,
 - c. wherein the first reactant flow field (80) defines a plurality of two-pass circuits (82, 84, 86, 88), each two-pass circuit being in fluid communication with a first reactant inlet (90) for directing the first reactant into the fuel cell (12), and in fluid communication with a first reactant outlet (92) for directing the first reactant out of the fuel cell (12).
2. The fuel cell (12) of claim 1, wherein each two-pass circuit (82, 84, 86, 88) defines a width across the two-pass circuit (82), when divided by a cross-flow length (114) of the first reactant flow field, that is greater than 0.1 and less than 0.5, wherein the width across each two-pass circuit (82) is a shortest distance across the two-pass circuit (82) in a direction perpendicular to flow of the first reactant through the two-pass circuit (82), and the cross-flow length (114) of the first reactant flow field (80) is a shortest distance across the first reactant flow field (80) in a direction perpendicular to flow of the first reactant through the flow field (80).

3. The fuel cell (12) of claim 1, wherein the first reactant flow field (80) is a cathode flow field (20) for directing flow of an oxygen containing oxidant reactant adjacent the selected surface (48) of the membrane electrode assembly.
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4. The fuel cell (12) of claim 1, wherein the first reactant flow field (80) is an anode flow field (28) for directing flow of a hydrogen containing reducing fluid adjacent the selected surface (50) of the membrane electrode assembly.
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5. The fuel cell (12) of claim 1, further comprising a second reactant flow field (28) secured adjacent the non-selected surface (48, 50) for directing flow of a second reactant adjacent the non-selected surface (48, 50), wherein the second reactant flow field (28) defines a plurality of two-pass circuits (82, 84, 86, 88), each two-pass circuit being in fluid communication with a reactant inlet (90) for directing the second reactant into the fuel cell (12), and in fluid communication with a reactant outlet (92) for directing the second reactant out of the fuel cell (12)
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6. The fuel cell (12) of claim 1, wherein the first reactant flow field (80) is a cathode flow field (20), the number of two-pass circuits (82, 84, 86, 88) in each reactant flow field is greater than or equal to 2 and less than 10, a width across a two-pass circuit (82) divided by a parallel-flow length of the two-pass circuit (82) is greater than 0.3 and less than 1.0, wherein the parallel-flow length of the two-pass circuit (82) is one-half of a shortest distance along the two-pass circuit (82) from a point of entry of the reactant stream into the
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circuit (82) to a point of exit of the reactant stream from the circuit (82) in a direction parallel to flow of the stream through the circuit (82).

7. A method of managing water within a fuel cell (12) comprising the steps of:

- a. securing a first reactant flow field (80) within a fuel cell (12) adjacent a surface of a membrane electrode assembly (46) selected from the group consisting of a first surface (48) and a second surface (50) of the assembly (46); and,
- b. directing a first reactant to flow through a plurality of two-pass circuits (82, 84, 86, 88) defined within the first reactant flow field (80).

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